

REMARKS

In response to the above-identified Office Action, Applicant amends the application and seeks reconsideration thereof. In this response, Applicant amends claims 28, 30 and 31, and cancels claim 29. Applicant does not add any claims. Accordingly, claims 28, 30-31, 33-34 and 37 are pending.

I. Drawings

The Patent Office objects to the figures under 37 CFR 1.83(a) stating, *inter alia*, that the figures do not show every limitation specified in the claims. In particular, the Patent Office states that the limitation, “a second single crystal portion having active devices formed thereon and defining a device surface wherein the dielectric layer of the first substrate portion is bonded directly to the device surface of the second substrate portion” as defined in claim 28 is not shown in Figure 11. Applicant respectfully disagrees.

Applicant directs the Patent Office’s attention to Figure 11. Reference number 350 contains active devices 352. Reference number 350 is directly coupled to reference number 301, which contains devices 316. Therefore, Figure 11 shows reference 350 directly coupled to reference 301. In addition, Applicant directs the Patent Office’s attention to the specification page 11, lines 9-14 to show that references 314 and 318 (shown in Figure 10) comprise reference 301. Accordingly, Applicant respectfully requests withdrawal of this objection to the figures.

In addition, the Patent Office states that the limitation, “first device surface of the primary substrate is connected directly to the second device surface of the at least one secondary single crystal substrate such that selected ones of said at least one secondary single crystal substrate are intercoupled via metal lines to selected ones of the first level of devices of the primary substrate” as defined in claim 31 is not shown in Figure 11. Applicant submits herewith a replacement figure to Figure 11 to comply with the Patent Office’s request.

The replacement figure shows device 352 intercoupled to device 316 via metal line 354. Applicant respectfully submits the replacement figure does not add any new matter since Figure 2 shows a configuration wherein devices on different substrates are intercoupled. Moreover, the specification at page 3, line 14 – page 4, line 15 shows the desirability of a device similar to the apparatus defined in claim 31. Accordingly, Applicant respectfully requests approval of the replacement figure.

II. Specification

Applicant has amended the specification to clarify replacement Figure 11. Applicant respectfully submits no new matter has been added to the specification and is supported by Figure 2 and the specification at page 3, line 14 – page 4, line 15. Accordingly, Applicant respectfully requests approval of the amendment.

III. Claims Rejected Under 35 U.S.C. §112

The Patent Office rejects claims 28-30, 33, 34 and 37 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. In particular, the Patent Office states, claim 28 and its dependent claims include “a first substrate portion having a dielectric layer on a surface, a second single crystal substrate portion having active devices formed thereon and defining a device surface wherein the dielectric layer of the first substrate portion is bonded directly to the device surface of the second substrate portion”, however, the specification does not disclose nor describe a structure as claimed. Applicant respectfully disagrees.

Applicant directs the Patent Office’s attention to Figure 11. Reference number 350 contains active devices 352. Reference number 350 is directly coupled to reference number 301, which contains devices 316. Therefore, Figure 11 shows reference 350 directly coupled to reference 301. In addition, Applicant directs the Patent Office’s attention to the specification page 11, lines 9-14 to show that references 314 and 318 (shown in Figure 10) comprise reference 301. Therefore, claim 28 and its dependent claims are supported by the specification. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 28.

In addition, the Patent Office states, claim 31 and its dependent claims include a “first device surface of the primary substrate as connected directly to the second device surface of the at least one secondary single crystal substrate such that selected ones of said active devices of said at least one secondary single crystal substrate are intercoupled via metal lines to selected ones of the first level of devices of the primary substrate”, however, the specification does not disclose nor describe a structure as claimed. Applicant has submitted a replacement figure for Figure 11.

The replacement figure shows device 352 intercoupled to device 316 via metal line 354. Applicant respectfully submits replacement figure does not add any new matter since Figure 2 shows a configuration wherein devices on different substrates are intercoupled. Moreover, the specification at page 3, line 14 – page 4, line 15 shows the desirability of a device similar to the

apparatus defined in claim 31. Therefore, claim 31 and its dependent claims are supported by the specification. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 31.

IV. Claims Rejected Under 35 U.S.C. §102

The Patent Office rejects claims 31 and 34 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,612,083 issued to Yasumoto ("Yasumoto"). Applicant amends claim 31.

To anticipate a claim, the relied upon reference must disclose every limitation of the claim. Among other elements, claim 31 defines an apparatus comprising a primary substrate having a first level of devices formed thereon and at least one secondary single crystal substrate having active devices formed thereon wherein the first device surface of the primary substrate is connected directly to the second device surface of the at least one secondary single crystal substrate by a thermal anneal at a temperature suitable to device structures. In making the rejection, the Patent Office characterizes Yasumoto as showing a primary substrate (12) having a first level (14) of active devices formed thereon and defining a first device surface and at least one secondary single crystal substrate (12') having active devices formed thereon on device layer (14) defining a second device surface, wherein the first device surface of the primary substrate is connected directly to the second device surface of the at least one secondary single crystal substrate. Applicant respectfully submits Yasumoto fails to teach each of the elements of claim 31.

Yasumoto teaches a process of fabricating a three-dimensional semiconductor device. See Yasumoto, col. 1, lines 8-9. In Yasumoto's device, interlevel functional layers 14 and 14' include various active and/or passive semiconductor elements formed in and/or on the substrate 12 and electrically isolated from one another. See Yasumoto, col. 5, lines 6-9, and col. 6, lines 42-48. Referring to Figure 1(f) of Yasumoto, layers 14 and 14' are not connected directly to each other since at least four other layers (layers 16, 22, 22', and 16') separate layers 14 and 14' with layers 16 and 16' being connected by a dielectric polymeric adhesive.

One trend in current fabrication is to increase device performance by lowering interlayer capacitance. Adding such a dielectric polymeric adhesive as Yasumoto teaches may adversely affect the dielectric capacitance of a device layer. Claim 31 recites that a primary substrate and a secondary substrate are directly connected, i.e., there is no requirement of an adhesive. Therefore, Yasumoto fails to teach each of the elements of independent claim 31 since the device taught therein connects the substrates using a polymeric adhesive which, itself, forms a layer. By contrast, claim 31 defines an apparatus with substrates connected by a thermal anneal so that the substrates are connected directly together.

The failure of Yasumoto to teach each of the elements of claim 31 is fatal to the anticipation rejection. Therefore, claim 31 is not anticipated by Yasumoto. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 31.

Claim 34 depends from claim 31 and contains all of the limitations thereof. Therefore, claim 31 is not anticipated by Yasumoto at least for the same reasons as claim 31. Accordingly, Applicant respectfully request withdrawal of the rejection of claim 34.

V. Claims Rejected Under 35 U.S.C. §103

The Patent Office rejects claims 28-29, 33 and 37 under 35 U.S.C. 103(a) as being obvious over U.S. Patent No. 4,489,478 issued to Sakurai ("Sakurai") in view of U.S. Patent No. 5,622,886 issued to Allum et al. ("Allum"). Applicant has cancelled claim 29 and amended claim 28.

To render a claim obvious, the relied upon references must teach or suggest every limitation of the claim such that the invention as a whole would have been obvious at the time the invention was made to one skilled in the art. Among other elements, claim 28 defines an apparatus comprising a first substrate having a plurality of active devices formed thereon and defining a first device surface and a second single crystal substrate having active devices formed thereon and defining a second device surface, wherein the first device surface of the first substrate is bonded directly to the device second surface of the second substrate by a thermal anneal at a temperature suitable to device structures on the first and second device structures. Applicant respectfully submits Sakurai in view of Allum fails to teach or suggest at least these elements of amended claim 28.

In making the rejection, the Patent Office characterizes the combination of Sakurai and Allum as teaching or suggesting each of the elements of claim 28. Sakurai teaches "a process for producing a semiconductor device." Sakurai, col. 1, lines 8-9. Figure 7 of Sakurai, as cited by the Patent Office, shows a semiconductor device having only one substrate (44a) containing devices. The Patent Office characterizes reference number 58 as a second substrate, however, reference 58 is a P-type polycrystalline silicon layer "deposited on the entire first semiconductor layer S₁ and is converted to a single crystal 58." Sakurai, col. 6, lines 42-45. Therefore, Sakurai teaches a single substrate with layers being deposited thereon. Thus, Sakurai fails to teach or suggest a first substrate having a plurality of active devices formed thereon and defining a first device surface and a second single crystal substrate having active devices formed thereon and defining a second device surface, wherein the first device surface of the first substrate is bonded directly to the device second surface of the second substrate. The Patent Office relies on Allum to cure the defects of Sakurai.

Allum teaches “power supplies, and in particular [to] a full wave bridge for a CMOS or NMOS integrated circuit.” Allum, col. 1, lines 9-11. However, the device taught by Allum has only a single layer containing devices. Therefore, Allum cannot teach or suggest multiple layers containing active devices bonded directly to each other.

In addition, the Patent Office does cite Allum as teaching or suggesting multiple layers containing active devices bonded directly to each other. Moreover, in reviewing Allum, Applicant has been unable to discern any sections in Allum that teach or suggest such a device. Thus, Allum fails to cure the defects of Sakurai.

The failure of the combination of Sakurai and Allum to teach or suggest each of the elements of claim 28 is fatal to the obviousness rejection. Therefore, claim 28 is not obvious over the prior art. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 28.

Claims 33 and 37 depend from claim 28 and contain all of the limitations thereof. Therefore, claims 30, 33 and 37 are not obvious over the prior art at least for the same reasons as claim 28. Accordingly, Applicant respectfully request withdrawal of the rejection of claims 30, 33 and 37.

VI. Claims Rejected Under 35 U.S.C. §103

The Patent Office rejects claim 30 under 35 U.S.C. 103(a) as being obvious over Sakurai in view of Allum and in further view of Yasumoto. Applicant respectfully traverses the rejection.

In making the rejection, the Patent Office characterizes Sakurai in view of Allum in further view of Yasumoto as teaching all of the limitations of claim 30. Claim 30 depends from claim 28 and contains all of the limitations thereof. Applicant has discussed all three references above and, for at least the reasons discussed above, submits that these references fail to teach or suggest each of the elements of claim 28 from which claim 30 depends. Particularly, in addition to the 35 U.S.C. 103 discussion above regarding Sakurai and Allum failing to teach or suggest each of the elements of claim 28, Applicant respectfully submits Yasumoto fails to cure the defects of this combination.

Yasumoto teaches at least four layers (layers 16, 22, 22', and 16') separating layers 14 and 14' with layers 16 and 16' being connected by a dielectric polymeric adhesive. As discussed above with regards to claim 31, the dielectric polymeric adhesive likewise precludes the substrates from being directly bonded as recited in claim 30. Therefore, Yasumoto fails to cure the defects of Sakurai and Allum.

The failure of the combination of Sakurai, Allum and Yasumoto to teach each of the elements of claim 30 is fatal to the obviousness rejection. Therefore, claim 30 is not obvious over the prior art. Accordingly, Applicant respectfully requests withdrawal of the rejection of claim 30.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending (1) are in proper form, (2) are neither obvious nor anticipated by the relied upon art of record, and (3) are in condition for allowance. A Notice of Allowance is earnestly solicited at the earliest possible date. If the Patent office believes that a telephone conference would be useful in moving the application forward to allowance, the Patent office is encouraged to contact the undersigned at (310) 207-3800.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly, extension of time fees.

Respectfully submitted,

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Nadya Gordon 12/2/03
Nadya Gordon Date